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Claims PTO

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1. Apparatus for mounting a ball grid array device comprising:

- 35 (a) a support member having a support face with a plurality of windows therein arranged in a pattern to correspond with and receive terminal balls depending from one face of a ball grid array device when said ball grid array device is positioned on the support face of said support member;
- 40 (b) a base member;
- (c) a bending plate having apertures therein substantially corresponding with said windows positioned between said base member and said support member and adapted for lateral movement with respect to said support member;
- 45 (d) a plurality of elongated contact members anchored in said base member, each having an interconnection end and a free end portion disposed on opposite sides of a central section with said central section projecting through an aperture in said bending plate and said free end portion positioned in a window in said support member; and
- 50 (e) a cam adapted to move the position of said bending plate laterally with respect to said support member and thereby urge said free end portions into contact with said terminal balls between the centerline thereof and the face from which they depend.
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2. Apparatus as defined in claim 1 wherein said free end portion of each of said contact members has a generally central axis and the extreme end of said end portion is deviated from said generally central axis.

3. Apparatus as defined in claim 2 wherein each said extreme end portion extends into a window in the support member but does not extend through said window.

65 4. Apparatus as defined in claim 1 wherein said cam contacts and moves said bending plate.

Claim 5 cancelled.

6. Apparatus as defined in claim 4 further comprising spring means to urge said bending plate laterally with respect to said support member.

7. Apparatus as defined in claim 5 further comprising spring means to urge said support member laterally with respect to said bending plate.

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8. (Amended) Apparatus as defined in claim 2 wherein the extreme end of said free end portion of each of said contact members extends into a window in said support member a sufficient distance to contact a [ball] terminal ball positioned in said window between the center of the [ball] terminal ball and the face of the device from which such [ball] terminal ball depends.

9. (Amended) Apparatus as defined in claim 1 further comprising spacers [removeably] removably affixed adjacent said support face to at least partially define the periphery of a ball grid array device to be positioned on said support face.

10. (Amended) Apparatus for mounting a ball grid array device comprising:

(a) a support member having a support face with a plurality of windows therein arranged in a pattern to correspond with and receive [ball terminals] terminal balls depending from the face of a ball grid array device when said ball grid array device is positioned on the support face of said support member;

(b) a base member;

(c) biasing means having apertures therein substantially corresponding with said windows positioned between said base member and said support member;

(d) a plurality of elongated contact members anchored in said base member, each having an interconnection end and a free end portion disposed on opposite sides and said free end portion defining a generally central axis with the extreme end portion of said free end portion deviated from said central axis and positioned in a window in said support member; and

(e) [(c)] means for moving said free end portions with respect to said window.

11. Apparatus as defined in claim 10 wherein each said extreme end portion extends into a window in the support member but does not extend through said window.

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12. (Amended) Apparatus as defined in claim 10 further comprising spacers [removeably] removably affixed adjacent said support face to at least partially define the periphery of ball grid array devices to be positioned on said support face.

13. (Amended) The combination comprising:

(a) a ball grid array device having a first face and a plurality of terminal balls depending from said first face in a predetermined pattern, each of said [ball terminals] terminal balls defining a geometric center spaced from said first face; and

(b) mounting apparatus comprising:

(i) a support member having a support face with a plurality of windows therein arranged in a pattern to correspond with and receiving said terminal balls depending from said first face of said ball array device;

(ii) a base member;

(iii) a bending plate having apertures therein substantially corresponding with said windows positioned between said base member and said support member; and

(iv) a plurality of elongated contact members, each having an interconnection end and a free end portion disposed on opposite sides of a central section with said central section projecting through an aperture in said bending plate and said free end portion positioned in one of said windows in said support member and terminating between said first face of said ball grid array and the geometric center of a terminal ball.

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14. The combination defined in claim 13 wherein said free end portion of each of said contact members has a generally central axis and the extreme end of said end portion is deviated from said generally central axis.

15. The combination defined in claim 14 wherein each said extreme end portion extends into a window in the support member but does not extend through said window.

16. The combination defined in claim 13 including means for moving said free end portions with respect to said windows.

17. The combination defined in claim 16 wherein said means for moving comprises a rotatable cam adjacent said bending plate which, when rotated, coacts with said bending plate to move said plate laterally with respect to said support member.

18. The combination defined in claim 17 wherein said means for moving includes a spring positioned to urge said bending plate laterally with respect to said support member.

19. The combination defined in claim 16 wherein said means for moving comprises a rotatable cam adjacent said support member which, when rotated, coacts with said support member to move said support member laterally with respect to said bending plate.

20. The combination defined in claim 19 wherein said means for moving includes a spring positioned to urge said support means laterally with respect to said bending plate.

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21. (Amended) Apparatus for mounting a ball grid array device comprising:

(a) a support member having a support face with a plurality of windows therein arranged in a pattern to correspond with and receive terminal balls depending from one face of a ball grid array device when said ball grid array device is positioned on the support face of said support member;

(b) a base member;

(c) a bending plate having apertures therein substantially corresponding with said windows positioned between said base member and said support member and adapted for lateral movement with respect to said support member;

(d) a plurality of elongated contact [member] members anchored in said base member, each having an interconnection end and a free end portion disposed on opposite sides of a central section with said central section projecting through an aperture in said bending plate and said free end portion positioned in a window in said support member; and

(e) [(c)] a cam adapted to move the position of said bending plate laterally with respect to said support member and thereby move said free end portions within said windows.

22. (Amended) Apparatus for mounting a ball grid array device comprising:

(a) a support member having a support face with a plurality of windows therein arranged in a pattern to correspond with and receive [ball terminals] terminal balls depending from the face of a ball grid array device when said ball grid array device is positioned on the support face of said support member;

(b) a base member;

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(c) biasing means having apertures therein substantially corresponding with said windows positioned between said base member and said support member;

(d) a plurality of elongated contact members anchored in said base member, each having an interconnection end and a free end portion disposed on opposite sides of a central section with said central section projecting through an aperture in said biasing means and said free end portion having an extreme end portion thereon positioned in a window in said support member; and

(e) [(c)] means for moving said free end portions with respect to said window.

23. (Amended) Apparatus for mounting a ball grid array device, the ball grid array device having terminal balls depending from the ball grid array device, and the apparatus comprising:

(a) a support member having a support face, wherein the ball grid array device is positioned on said support face of said support member;

(b) a base member;

(c) a bending plate having apertures therein substantially corresponding with the terminal balls, said bending plate positioned between said base member and said support face of said support member and adapted for lateral movement with respect to said support member;

(d) a plurality of elongated contact members anchored in said base member, each having an interconnection end and a free end portion disposed on opposite sides of a central section with said central section projecting through an aperture in said bending plate, and said free end portion positioned to extend adjacent to a respective one of the terminal balls of the ball grid array device; and

(e) a cam adapted to move the position of said bending plate laterally with respect to said support member and thereby urge said free end portions into contact with the terminal balls.

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24. Apparatus as defined in Claim 23 wherein said free end portion of each of said contact members has a generally central axis and the extreme end of said end portion is deviated from said generally central axis.

25. (Twice Amended) Apparatus as defined in Claim 24 wherein each said extreme end portion extends into an open space in said support member but does not extend through said open space in said support member.

26. Apparatus as defined in Claim 23 wherein said cam contacts and moves said bending plate.

Claim 27 cancelled.

28. Apparatus as defined in Claim 26 further comprising spring means to urge said bending plate laterally with respect to said support member.

29. Apparatus as defined in Claim 27 further comprising spring means to urge said support member laterally with respect to said bending plate.

30. (Twice Amended) Apparatus as defined in Claim 24 wherein the extreme end of said free end portion of each of said contact members extends beneath a face of the ball grid array device from which said terminal balls depend a sufficient distance to contact a terminal ball between the center of the terminal ball and the face of the device from which such terminal ball depends.

31. (Amended) Apparatus as defined in Claim 23 further comprising spacers removeably affixed adjacent said support face to at least partially locate the periphery of a ball grid array device relative to said support member.

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32. (Amended) Apparatus for mounting a ball grid array device, the ball grid array device having terminal balls depending from one face of the ball grid array device, and said apparatus comprising:

(a) a support member having a support face on which said ball grid array device is located relative to said support member;

(b) a base member;

(c) biasing means having apertures therein substantially corresponding with the locations of said terminal balls;

(d) a plurality of elongated contact members anchored in said base member, each having an interconnection end and a free end portion disposed on opposite sides of a central section with said central section projecting through an aperture in said biasing means and said free end portion defining a generally central axis with the extreme end portion of said free end portion deviated from said central axis and positioned adjacent a respective one of said terminal balls of said ball grid array device; and

(e) means for moving said free end portions with respect to said support member.

33. (Twice Amended) Apparatus as defined in Claim 32 wherein each said extreme end portion extends into an open space in said support member but does not extend through said open space in said support member.

34. (Amended) Apparatus as defined in Claim 32 further comprising spacers removably affixed adjacent said support face to at least partially locate the periphery of ball grid array devices relative to said support face.

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35. (Amended) The combination comprising:

(a) a ball grid array device having a first face and a plurality of terminal balls depending from said first face in a predetermined pattern, each of said terminal balls defining a geometric center spaced from said first face; and

(b) mounting apparatus comprising:

(i) a support member adjacent to which said ball grid array device is located;

(ii) a base member;

(iii) a bending plate having apertures therein substantially corresponding with said terminal balls positioned between said base member and said support member; and

(iv) a plurality of elongated contact members, each having an interconnection end and a free end portion disposed on opposite sides of a central section with said central section projecting through an aperture in said bending plate and said free end portion positioned adjacent to a respective one of said terminal balls and terminating between said first face of said ball grid array and the geometric center of said respective one of said terminal balls.

36. The combination defined in Claim 35 wherein said free end portion of each of said contact members has a generally central axis and the extreme end of said end portion is deviated from said generally central axis.

37. (Amended) The combination defined in Claim 36, wherein each said extreme end portion extends into an open space in said support member but does not extend through said open space in said support member.

38. (Twice Amended) The combination defined in Claim 35 including means for moving said free end portion with respect to the terminal balls depending from the face of the ball grid array device.

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39. The combination defined in Claim 38 wherein said means for moving comprises a rotatable cam adjacent said bending plate which, when rotated, coacts with said bending plate to move said plate laterally with respect to said support member.

40. The combination defined in Claim 39 wherein said means for moving includes a spring positioned to urge said bending plate laterally with respect to said support member.

41. The combination defined in Claim 38 wherein said means for moving comprises a rotatable cam adjacent said support member which, when rotated, coacts with said support member to move said support member laterally with respect to said bending plate.

42. The combination defined in Claim 41 wherein said means for moving includes a spring positioned to urge said support means laterally with respect to said bending plate.

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43. (Amended) Apparatus for mounting a ball grid array device, the ball grid array device having terminal balls depending from the ball grid array device, and said apparatus comprising:

(a) a support member having at least one support surface against which the ball grid array device is disposed to locate the ball grid array device in a desired position relative to said support member;

(b) a base member;

(c) a bending plate having apertures therein substantially corresponding with the terminal balls, said bending plate positioned between said base member and said support member and adapted for lateral movement with respect to said support member;

(d) a plurality of elongated contact members anchored in said base member, each having an interconnection end and a free end portion disposed on opposite sides of a central section with said central section projecting through an aperture in said bending plate and said free end portion positioned adjacent to a respective one of the terminal balls; and

(e) a cam adapted to move the position of said bending plate laterally with respect to said support member and thereby move said free end portions against respective ones of the terminal balls.

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44. (Amended) Apparatus for mounting a ball grid array device, the ball grid array device having terminal balls depending from one face of the ball grid array device, and said apparatus comprising:

- (a) a base member;
- (b) a support member having a support face against which the ball grid array device is located, with said terminal balls extending toward said base member;
- (c) biasing means having apertures therein substantially corresponding with said terminal balls, said biasing means positioned between said base member and said support face of said support member;
- (d) a plurality of elongated contact members anchored in said base member, each having an interconnection end and a free end portion disposed on opposite sides of a central section with said central section projecting through an aperture in said biasing means and said free end portion having an extreme end portion thereof positioned adjacent respective ones of the terminal balls; and
- (e) means for moving said free end portions with respect to said terminal balls.

45. Apparatus as defined in Claim 44, wherein said terminal balls extend downward from said support face, and said base member is disposed beneath said support face.

46. Apparatus as defined in Claim 44 wherein each said extreme end portion extends into an open space in said support member but does not extend through said open space in said support member.

47. Apparatus for mounting a ball grid array device, the ball grid array device having an array of terminal balls depending from the ball grid array device, and said apparatus comprising:

- (a) a support member having a support face, wherein the ball grid array device is

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positioned on said support face such that at least a portion of said support face supportingly engages the ball grid array device;

(b) a base member;

(c) a bending plate having apertures therein substantially corresponding in relative relation with the terminal balls depending from the ball grid array device, and adapted for lateral movement with respect to said support member;

(d) a plurality of elongated contact members anchored in said base member, each having an interconnection end and a free end portion disposed on opposite sides of a central section, with said central section projecting through a respective one of said apertures in said bending plate and said free end portion positioned to extend adjacent to a respective one of the terminal balls of the ball grid array device; and

(e) a cam adapted to move the position of said bending plate laterally with respect to said support member and thereby urge said free end portions of said elongated contact members into contact with the respective ones of the terminal balls.

48. Apparatus as defined in Claim 47 wherein said free end portion of each of said contact members has a generally central axis and the extreme end of said end portion is deviated from said generally central axis.

49. Apparatus as defined in Claim 47 wherein said cam contacts and moves only one of said bending member and said support member, and said apparatus further comprising spring means to urge said one of said bending plate and said support plate laterally with respect to the other of said bending plate and said support member.

50. Apparatus as defined in Claim 47 wherein the extreme end of said free end portion of each of said contact members extends a sufficient distance to contact a respective terminal ball between the center of the terminal ball and the face of the device from which such terminal ball depends.

51. Apparatus as defined in Claim 47 further comprising spacers disposed adjacent said

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support face to at least partially locate a periphery of the ball grid array device in a lateral position relative to said on said support face.

52. Apparatus for use with a ball grid array device of the type having an array of terminal balls extending therefrom, said apparatus comprising:

a support member having a support face for supporting thereon the ball grid array device, said support member having a stop for engaging the ball grid array device to locate the ball grid array device with respect to said support member;

a bending member having a plurality of apertures generally registered with the terminal balls when the ball grid array device is located with respect to said support member;

a base member;

a plurality of elongated contact members secured in said base member and extending from said base member, through respective ones of said apertures in said bending member and toward the ball grid array device, said elongated contact members each having contact ends extending so as to be positioned to a side of a respective terminal ball of said ball grid array device; and

a cam adapted for moving at least one of said bending member and said support member to thereby move the contact ends of said elongated contact members sideways into contact with respective terminal balls.

53. The apparatus of Claim 52, wherein said support member is positioned over said bending member, and said bending member is positioned over said base member, and said contact ends of said elongated contact members extend into an area occupied by said support member, whereby when the ball grid array device rests on said support face and is engaged with said stop, said contact ends of said elongated contact members are adjacent respective terminal balls of the ball grid array device.

54. The apparatus of Claim 53, wherein said support member includes in said area occupied by said support member, an array of windows, and each contact end of said contact members extends into a respective one of said windows.

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55. Apparatus as defined in Claim 52 wherein said free end portion of each of said contact members has a generally central axis and the extreme end of said end portion is deviated from said generally central axis.

56. Apparatus as defined in Claim 52 wherein said cam contacts and moves only one of said bending member and said support member, and said apparatus further comprising spring means to urge said one of said bending plate and said support plate laterally with respect to the other of said bending plate and said support member.

57. Apparatus as defined in Claim 52 herein the extreme end of said free end portion of each of said contact members extends a sufficient distance to contact a respective terminal ball between the center of the terminal ball and the face of the device from which such terminal ball depends.

58. Apparatus as defined in Claim 52, wherein said stop comprises a spacer disposed adjacent said support face to at least partially locate a periphery of the ball grid array device laterally relative to with respect to said support face.

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